

CONDENSED MILK AND ITS VALUE FOR GENERAL USE AND FOR INFANT FEEDING.

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The use of this type of milk has become so extensive as to warrant an investigation of the quality of some of the brands upon the market. The demand for condensed milk appears to be constantly increasing, and received a great impetus in 1907, when the price of whole milk was advanced throughout the city. This inquiry was commenced with a view of gaining an insight into the quality of some of these products, in order to determine whether or not their employment as substitutes for milk and cream is founded on economic principles, and also to ascertain if they are suitable for infant feeding. The claims made upon the labels of many of these specimens form an ample basis for study as to their value, when diluted with water according to directions, for subsequent use by both adults and the young. This research did not include all of the brands upon the market, but was confined to those which seemed to fairly represent the two types of condensed milk, namely, the sweetened and unsweetened varieties. The names of the brands examined, together with other information and the results of the analyses* are given in the following table:

*METHODS—The methods used in the chemical examination of the sweetened condensed milks were those given in the U. S. Dept. Agriculture, Bureau Chemistry Bulletin 107, pp. 122 and 123, except that in the determination of protein by the Gunning method the factor 6.38 was used instead of 6.25.

In the chemical examination of unsweetened evaporated milks, the following methods were used: Total solids, Bulletin 107, p. 123; Ash, Bulletin 107, p. 123; Milk Sugar, Optical Method; Proteids, by difference. Fat, a special modification of the Babcock Method, as follows:

Weigh 6.00 grams thoroughly mixed evaporated milk into a ten per cent Babcock Test Bottle. Add ten cubic centimeters of water, and mix thoroughly. Add 17.5 cubic centimeters sulphuric acid (s. g. 1.81) and, after mixing by rotation in the usual manner until all curd is apparently dissolved, place the bottle with contents in boiling water for twenty minutes. Finally, place test bottle with contents in centrifugal machine and finish as in regular Babcock Method.

TABLE A.

I. ANALYSES OF CONDENSED MILK.													II. DEGREE OF CONDENSATION, CALCULATIONS BASED ON.					III. CALCULATED FAT IN ORIGINAL MILK					Ratio of Protein to Fat
Brand	Price per Can, Cents	Wt. of Contents of Can, Ounces	Water	Total Solids	Cane Sugar	Milk Solids	Ash	Protein (N x 6.38)	Milk Sugar	Fat	Pat in 12 1/2 Milk Solids.	0.64% Ash	8.5% Solids Not Fat	8.9% Solids Not Fat	9.3% Solids Not Fat	Average	0.64% Ash	8.5% Solids Not Fat	8.9% Solids Not Fat	9.3% Solids Not Fat	Average		
Challenge.....	11	372	29.30	70.70	37.11	33.59	1.50	7.88	15.66	8.55	3.09	3.73	4.68	4.48	4.28	4.24	3.64	2.90	3.03	3.17	3.20	0.92	
Green Mountain.....	11	372	23.80	76.20	41.47	34.73	1.90	9.29	14.84	8.70	3.04	5.07	5.23	4.99	4.77	5.00	2.93	2.84	2.97	3.11	2.97	1.07	
Summit.....	10	372	28.60	71.40	41.00	30.40	1.85	8.88	11.72	7.95	3.18	4.90	4.47	4.27	4.08	4.42	2.75	3.03	3.17	3.30	3.05	1.12	
Cupid.....	10	337	24.10	75.90	45.32	30.58	1.54	8.55	14.04	6.45	2.56	4.40	5.19	4.96	4.75	4.82	2.69	2.27	2.38	2.48	2.45	1.32	
Standard.....	11	403	25.80	74.20	41.63	32.57	1.75	8.37	13.60	8.85	3.30	4.69	4.78	4.57	4.37	4.60	3.23	3.17	3.32	3.47	3.30	0.95	
Rose.....	12	410	27.65	72.35	38.76	33.59	1.58	7.83	15.18	9.00	3.27	4.04	4.73	4.52	4.32	4.40	3.64	3.11	3.26	3.41	3.34	0.87	
Tip Top.....	12	412	27.20	72.80	38.78	34.02	1.40	8.18	15.44	9.00	3.22	3.58	4.81	4.59	4.39	4.34	4.11	3.06	3.20	3.35	3.39	0.91	
Defiance.....	10	372	23.40	76.60	45.87	30.73	1.50	7.90	13.38	7.95	3.15	4.34	4.94	4.73	4.52	4.63	3.38	2.97	3.11	3.26	3.17	0.99	
Eclipse.....	12	424	24.90	75.10	44.01	31.09	1.51	8.24	13.54	7.80	3.05	4.22	4.89	4.68	4.48	4.57	3.31	2.85	2.97	3.11	3.05	1.06	
Red Cross.....	11	410	24.25	75.75	43.01	32.74	1.51	8.73	14.10	8.40	3.12	4.15	5.02	4.79	4.58	4.63	3.55	2.94	3.08	3.22	3.18	1.04	
St. Charles*.....	10	338	70.15	29.85	.....	29.85	1.40	8.80	10.95	8.70	3.55	2.19	2.49	2.37	2.27	2.33	3.97	3.49	3.67	3.83	3.74	1.01
Van Camp*.....	10	447	73.05	26.95	.....	26.95	1.50	8.30	9.80	7.35	3.32	2.34	2.31	2.21	2.11	2.25	3.14	3.18	3.33	3.48	3.27	1.13
Carnation*.....	5	180	75.60	24.40	.....	24.40	1.15	7.95	8.10	7.20	3.58	1.80	2.02	1.93	1.85	1.90	4.00	3.56	3.73	3.89	3.79	1.10
Carnation*.....	10	450	73.65	26.35	.....	26.35	1.25	7.90	9.10	8.10	3.75	1.96	2.15	2.05	1.96	2.03	4.13	3.77	3.95	4.13	3.99	0.98
Highland*.....	10	333	71.10	28.90	.....	28.90	1.30	9.00	9.60	9.00	3.79	2.03	2.34	2.24	2.14	2.19	4.43	3.85	4.02	4.21	4.11	1.00

* Unsweetened condensed milk.

While these findings may be considered from various points of view, the fat content of condensed milk is of chief importance from the manufacturer's standpoint, for the reason that the commercial value of milk is calculated on a fat basis. Under these circumstances the use of low grade milk, i. e., containing a small amount of fat, or a milk from which a portion of the fat has been removed (for cream or butter), will yield the manufacturer a higher profit than though a normal milk was employed. Thus the quality of milk used in these products is of interest to the consumer, and likely to be of financial advantage to the manufacturer. Unfortunately there is no method by which the exact amount of fat in the original milk may be determined. It is true, however, that calculations may be and are often employed to establish the quantity of fat in the milk before condensation, but at the best the results so obtained are only approximate. They are largely based upon the assumption that arbitrary factors, (as those for milk solids, solids not fat, or ash), selected for calculation purposes, represent the original milk. By employing for such data, however, average factors, close resemblance to the fat content may be attained. The calculations in the above table were to ascertain the degree of concentration and amount of fat in the milk used by the manufacturer. While the results obtained by use of the various factors are of interest, the averages are of chief importance, particularly in the closeness with which the average percentage of calculated fat agrees with the result obtained when 12.15 (the legal percentage of milk solids in Massachusetts) is used in determining this fat value. It is believed that the figures from this latter method, and the averages above mentioned, represent nearly the quality of milk which entered into these products.

It will be observed that there is considerable variation in the percentage of fat in the condensed milk, as shown in Table A. In the sweetened samples the minimum amount is 6.45 per cent, and the maximum 9.00 per cent, a difference of 2.55 per cent. In the unsweetened the difference is less, being 1.80 per cent, the minimum quantity being 7.20 per cent. and the maximum 9.00 per cent. Thus this product is extremely variable as to composition, not only as between different brands, but specimens of the same brand are not constant as to fat content; a difference of 0.9

per cent of fat having been found in two samples of one make. These differences are further emphasized by the work of other investigators.

While it is not possible, as previously indicated, to determine the exact amount of fat in the original milk from which condensed milk is prepared, approximations show that in the preparation of some of the above specimens, either milk of abnormally low grade was used, or milk was employed from which a portion of the cream had first been removed. In any event it is significant that very few of the samples shown in the above table indicate that milk of high grade was employed in their manufacture.

Despite the fact that the exact composition of the milk prior to condensation cannot be ascertained, it is feasible to estimate the value of condensed milk when diluted with water for use by the consumer. This has been accomplished by determining the cost of a quart of standard milk (Massachusetts law) containing 3.35 per cent* of fat, when made from these products by means of the addition of water. The weight, fat content and price of each brand was the data upon which these calculations were based.

The results appear in Table B.

TABLE B.
SHOWING THE COST OF A QUART OF STANDARD MILK CONTAINING 3.35 PER CENT OF FAT, WHEN MADE FROM CONDENSED MILK.

Brand	Cost Per Quart	Brand	Cost Per Quart
Green Mountain.....	11.1 cents	Van Camp.....	10 cents
Standard.....	10.1 "	Summit.....	11.1 "
Eclipse.....	11.9 "	Tiptop.....	10.6 "
Red Cross.....	10.4 "	Rose.....	10.6 "
Highland.....	10.9 "	Challenge.....	11.4 "
Carnation(5 cent can)	12.6 "	Defiance.....	11.1 "
" (10 cent can)	9. "	St. Charles.....	11.2 "
Cupid.....	15.1 "		

*Much of the commercial milk has a fat content in excess of this amount.

It is plainly apparent from these figures that the use of condensed milk is unwarranted, if motives of economy are to be considered. The cheapest milk when so prepared, namely, that made from the Carnation brand, exceeds the price at which the householder usually purchases milk, nearly equals that of inspected milk, and, the cost in all other instances exceeds the price of inspected milk, and with two brands the expense would be above that of certified milk. It follows then in practically every instance that the product made by diluting condensed milk is the most expensive which the consumer can purchase; furthermore, from another point of view, comparison with inspected and certified milk is still less favorable to diluted condensed milk, for the production of milk for condensing purposes is never attended with the precautions for care and cleanliness which characterizes inspected and certified milk dairies. Inspected and certified milk is also procured from tuberculin tested cows, which cannot be claimed for that used in condensaries.

Condensed milk has a limited legitimate field, for which it was originally intended; namely, that of supplying a product where fresh milk is not available. Other than this its use is attended with unnecessary and unwarranted expense to the purchaser. The energy involved in the preparation of condensed milk, the tin cans used for containers, the marketing and advertising are factors tending to make the diluted milk expensive, and for all of these items the consumer pays. Small wonder that the cost of a quart of such milk is large. Where fresh milk can be obtained, the employment of condensed milk as a substitute is a luxury.

All of the samples examined bore labels upon which appeared directions for diluting the contents. It was deemed of interest to ascertain the character of the product which resulted when these directions were followed. This data was calculated from the original analyses. For comparative purposes it should be borne in mind that the standard for milk in this state is not less than 12.15 per cent of milk solids and not less than 3.35 per cent of fat. The results follow:

TABLE C.—COMPOSITION OF MIXTURES OF CONDENSED MILK AND WATER PREPARED AS DIRECTED FOR ORDINARY USE

Brand	Proportion of Milk to Water	Water %	Milk Solids %	Fat %	Milk Sugar %	Cane Sugar %	Pro- teids %	Ash %
SWEETENED								
Summit.....	1 to 4	85.72	6.09	1.59	2.35	8.19	1.78	0.37
".....	1 to 3	82.14	7.61	1.99	2.93	10.25	2.22	0.47
Tip Top.....	1 to 4	85.43	6.81	1.80	3.09	7.76	1.64	0.28
Rose.....	1 to 3	81.79	8.51	2.25	3.86	9.70	2.05	0.35
".....	1 to 4	85.51	6.73	1.80	3.04	7.76	1.57	0.32
Challenge.....	1 to 3	81.90	8.40	2.25	3.80	9.70	1.96	0.39
".....	1 to 4	85.85	6.72	1.71	3.13	7.43	1.58	0.30
Defiance.....	1 to 3	82.30	8.41	2.14	3.92	9.29	1.97	0.38
".....	1 to 4	84.66	6.15	1.59	2.68	9.19	1.58	0.30
Green Mountain.....	1 to 3	80.81	7.70	1.99	3.35	11.49	1.98	0.38
".....	1 to 4	84.76	6.95	1.74	2.97	8.29	1.86	0.38
Standard.....	1 to 3	80.96	8.68	1.74	3.71	10.36	2.32	0.48
Eclipse.....	1 to 3	81.48	8.14	2.21	3.40	10.38	2.09	0.44
".....	1 to 4	84.96	6.22	1.56	2.71	8.82	1.65	0.30
Red Cross (a).....	1 to 3	81.22	7.78	1.95	3.39	11.00	2.06	0.38
".....	1 to 4	82.13	16.37	4.20	7.05	21.50	4.37	0.75
Cupid.....	1 to 4	84.83	6.55	1.68	2.82	8.62	1.75	0.30
".....	1 to 4	84.80	6.12	1.29	2.81	9.08	1.71	0.31
".....	1 to 3	81.01	7.65	1.61	3.51	11.34	2.14	0.39
UNSWEETENED								
Carnation (5 cent can).....	1 to 2	91.87	8.13	2.40	2.70	None	2.65	0.38
".....	1 to 2	91.21	8.79	2.70	3.03	"	2.64	0.42
St. Charles (b).....	1 to 1†	85.06	14.94	4.36	5.48	"	4.40	0.70
".....	1 to 2†	90.05	9.95	2.90	3.65	"	2.93	0.47
".....	1 to 3†	92.53	7.47	2.18	2.74	"	2.20	0.35
Van Camp (c).....	1 to 1	86.53	13.47	3.67	4.90	"	4.15	0.75
".....	1 to 2	91.03	8.97	2.45	3.26	"	2.76	0.50

* "Cream," † "Rich milk," ‡ "Economical milk."

(a) 20.6 fluid ounces of this mixture would cost 11 cents.
 (b) 22.4 " " " " 10 cents.
 (c) 29.6 " " " " 10 cents.

It will be observed from the above figures that the product of these dilutions in all but three instances is of extremely poor quality, and not suitable to be characterized or used as milk. Those who prepare milk on the above basis are practising self-deception. Each consumer who follows these labelled directions thus becomes a milk adulterator, and is using water with a degree of liberality which would astonish the most brazen of former old-time milk manipulators. With three exceptions, the value of these diluted products depends principally upon bulk; quality is a minor consideration. They are mostly rich in water, but in little of other milk constituents. More economy would follow and there would be no sacrifice of quality (eliminating the above exceptions), if to a quart of fresh milk one-third to more than one quart of water was added. Products would result in nearly every instance which would equal the extremes of those which appear in the above table. In the case of the three exceptions previously mentioned, where the products are diluted with an equal part of water, mixtures result containing more than the legal amount of fat but their cost, considering the resulting volumes, would by comparison with the price of an equal bulk of milk be prohibitive. Sweetened condensed milk may be diluted to a greater extent than the unsweetened, without the difference in thinness becoming manifest, by reason of the "body" given the sweetened product by the added sugar.

It is largely upon the fraud basis, namely, the supposition that condensed milk could be diluted freely with water, and that the resulting mixtures possessed the approximate qualities of normal milk, that manufacturers of condensed milk have secured the present enormous and profitable business. The public has been deceived, and for this the manufacturers are responsible. The directions on the labels of some of these brands are general, while with others they are specific. One, the "Peerless,"* directs dilution with water to the required consistency for "purposes where ordinary milk or cream would be used." The sample of the condensed product examined contained only 8.00 per cent of fat, while the legal fat standard of cream in Massachusetts is 15 per cent. Even without dilution the Peerless

* The analysis of this brand does not appear in Table A.

brand would not be legal cream in this state. The label on the St. Charles brand states that the product has been "reduced to the consistency of cream." It contained only 8.70 per cent of fat, and the "rich milk" made by diluting this product according to directions would have contained fat as follows:

(1 of milk to 1 of water) = 3.98 per cent of fat; (1 of milk to 2 of water) = 2.65 per cent of fat, while the "economical milk" (1 of milk to 3 of water) = 1.99 per cent of fat.

The label of the Highland brand states that for certain uses "it may be slightly diluted with water, and for other purposes it may be further diluted to any desired consistence." The original contained 9.00 per cent of fat.

The label on the Red Cross brand states that "mixed with an equal quantity of water, an excellent quality of cream is produced." A mixture so made would contain only 4.50 per cent of fat. The "rich milk" of this brand, prepared according to directions, would contain only 2.59 per cent of fat. Dilute "according to personal taste" with "one or two parts of water" is the recommendation on the label of the Van Camp brand. These mixtures would have contained fat respectively as follows:

(1 of milk and 1 of water) = 3.67 per cent of fat. (1 of milk and 2 of water) = 2.45 per cent of fat.

Thus statements not always characterized by truth find a conspicuous place upon the labels of many brands of condensed milk, and these claims are apparently valuable assets to the condensed milk business.

The most important feature of these preparations in their bearing upon the human economy is that of their employment for infant feeding. Directions for making dilutions for this purpose appear upon the labels of many brands. The fallacy of their use as nourishment for infants is shown in the following table, which indicates the proportion of the constituents of the different mixtures, when made according to the printed formulae. These percentages are calculated from the analyses of the undiluted milk, like those in the preceding table.

TABLE D.—COMPOSITION OF INFANT FOODS WHEN PREPARED AS DIRECTED.

Brand	Age of Infant	Proportion of Milk to Water	Water %	Milk Solids %	Fat %	Milk Sugar %	Cane Sugar %	Proteids %	Ash %
Highland*	1 week.....	1 to 16†	98.29	1.71	0.53	0.57	None	0.53	0.077
"	10-12 months...	10 to 36†	93.76	6.24	1.96	2.07	"	1.93	0.28
St. Charles*	1 month.....	1 to 7	96.26	3.74	1.09	1.37	"	1.10	0.18
"	2 months.....	1 to 6	95.74	4.26	1.24	1.56	"	1.26	0.20
"	1 year.....	1 to 3	92.54	7.46	2.17	2.74	"	2.20	0.35
Red Cross.....	1 month.....	1 to 13	94.60	2.33	0.60	1.01	3.07	0.62	0.10
"	2 months.....	1 to 11	93.69	2.73	0.70	1.18	3.58	0.73	0.12
"	3 months.....	1 to 10	93.12	2.97	0.76	1.28	3.91	0.79	0.14
"	6 months.....	1 to 9	92.43	3.27	0.84	1.41	4.30	0.87	0.15
"	1 year.....	1 to 6	89.17	4.68	1.20	2.02	6.15	1.25	0.21
Green Mountain.....	Use according to age and strength of child	1 to 14	94.91	2.32	0.58	0.99	2.77	0.62	0.13
"	"	1 to 8	91.53	3.86	0.97	1.65	4.61	1.03	0.21
Summit.....	"	1 to 14	95.24	2.02	0.53	0.78	2.74	0.59	0.12
"	"	1 to 8	92.06	3.38	0.88	1.30	4.56	0.99	0.21
Standard.....	New-born.....	1 to 16	95.64	1.91	0.52	0.80	2.45	0.49	0.10
"	"	1 to 14	95.05	2.18	0.59	0.91	2.77	0.56	0.12
Carnation (5 cent can)*	Reduce according to age	1 to 6	96.51	3.49	1.03	1.16	None	1.14	0.16
"	"	1 to 4	95.12	4.88	1.44	1.62	"	1.59	0.23
"	"	1 to 6	96.23	3.77	1.16	1.30	"	1.13	0.18
"	"	1 to 4	94.73	5.27	1.62	1.82	"	1.58	0.25
"	"	1 to 14	94.94	2.04	0.43	0.94	3.02	0.57	0.10
Cupid.....	Use according to age and strength of child.	1 to 8	91.57	3.40	0.72	1.56	3.03	0.95	0.17

* Unsweetened.

† The addition of cane sugar is suggested by the printed directions.

Some of the brands make no claim of adaptability for infant feeding and are omitted from this classification, while others seek to foster the use of this substance. One, the Red Cross, under the caption "Important to Mothers" asserts that "Red Cross is prepared especially for Infants. The most perfect substitute for mother's milk. Feed it to your babies and you will use no other. It possesses special nutritive qualities as a food for children." The composition of these mixtures, as shown in the above table, presents a condition both condemnable and criminal. The manufacturers of condensed milk could not have advocated, even though it be by implication, their employment so diluted, without being aware of the small amount of food value which they represented. Such a degree of culpability warrants the severest censure. The profit resulting from the sale of condensed milk for infant feeding, on the basis of these labelled directions, is iniquitous. Not one of these mixtures, even the most concentrated, represents the composition of normal milk during any period following child birth. They rather imitate starvation diet. The employment of milk for an infant not a week old, containing 0.53 per cent of fat, 0.57 per cent of milk sugar, 0.53 per cent of proteids and 0.077 per cent of ash, when human milk four to six days after child birth* contains 2.97 per cent of fat, 6.47 per cent of milk sugar, 2.25 per cent of proteids, and 0.30 per cent of ash, is likely to be attended with disastrous results. This single example is sufficient to show the fallacy of these printed statements. There is the further disadvantage of the presence of cane sugar in these sweetened condensed milks, and in the formulae of some of the unsweetened products the addition of cane sugar is recommended. This is important, in view of the fact that many physicians are of the opinion that this substance is to be avoided in infant feeding. Assuredly its employment should not be suggested by a manufacturer, even though it is essential to the financial success of his product.

There is another aspect of this condensed milk question not lacking in interest, namely, that of bacterial content. Undoubtedly this substance is supposed by laymen to be free from bacteria, and the printed matter upon some of the packages is not

*Carter & Richmond. *Dairy Chemistry*, by Henry Droop Richmond, p. 324.

such as to disabuse the minds of consumers upon this point. The fact is that while a few of the brands were found to be sterile, with the majority there is no uniformity respecting bacterial content, and while one or more samples of a brand may be sterile, other packages of the same brand may contain large numbers of organisms. This condition was demonstrated by the examinations which were made. The brands found to contain bacteria appear in Table E together with the maximum counts obtained.

TABLE E.
*BACTERIOLOGIC EXAMINATION OF CONDENSED MILK.

Brand	Bacteria Per Cubic Centimeter	Brand	Bacteria Per Cubic Centimeter
Tip Top.....	200,000	Green Mountain....	570,000
Defiance.....	520,000	Red Cross.....	560,000
Cupid.....	2,000	Challenge.....	10,000,000
Standard.....	900	Eclipse.....	280,000
Summit.....	17,500	Rose.....	850,000

* These examinations were made in the Bacteriological Laboratory of the Boston Board of Health through the courtesy of the Director, Dr. Francis H. Slack.

SUMMARY.

First. Condensed milk is seldom prepared from milk rich in fat. Analyses of several of the samples indicate that in a majority of the brands the original milk used was either of low grade in respect to percentage of fat, or that the milk had been skimmed.

Second. The present extensive employment of condensed milk is mainly due to the fact that consumers believe these products can be largely diluted with water, and yield a mixture which closely approximates the composition of milk. This opinion is fostered by the printed matter which appears upon the labels of the different brands. By following the definite and indefinite directions for water dilutions, mixtures impoverished in all milk constituents other than water are obtained, and the

latter is present in excessive amounts, with the exception of the three brands before mentioned, and then only when dilution is with an equal bulk of water.

Third. If condensed milk is diluted with only enough water to make a quart of Massachusetts standard milk, i. e., containing 3.35 per cent of fat, the cost of the latter exceeds the price of ordinary milk, and in some instances equals the price of inspected milk, and in others is more than that of some brands of certified milk. It follows that condensed milk cannot be employed economically where whole milk is procurable.

Fourth. Condensed milk is recommended by implication as a food for infants by those who manufacture it, and directions for dilution for this purpose appear upon the labels of most brands. Mixtures made according to the formulae suggested would be deficient in practically every instance in percentage of milk constituents, as compared with human milk. Furthermore, they either contain or the printed directions suggest the addition of cane sugar, which substance is deemed an objectionable ingredient of infant foods by many physicians. The employment of condensed milk for this purpose is no doubt often at the expense of infant life, and is to be vigorously condemned. The labels on these packages should bear a warning against the use of the contents as food for babies.

Fifth. The impression that most condensed milk is free from bacteria is not founded on fact.

Sixth. There is no justification in the use of misleading statements by the manufacturers of these substances. This should be prohibited by law.

Seventh. Packages of condensed milk should bear a formula for diluting with water, so that the resulting product shall not be below the standard for milk solids and fat of any state in which the original product may be sold. Legislation to this end should be sought in every State in the Union.

DISCUSSION.

Dr. FRANCIS H. SLACK. Professor Jordan's paper has thrown a flood of light on this subject, and such information should be widespread, in order that people may not be deceived by the labels that go out upon this kind of milk. We have long been finding fault with impure milk and condemning it because of its share in producing high infant mortality and morbidity. If we can condemn our market milk for that I think we can more justly condemn condensed milk, which not only may be high in bacterial content, but, as has been shown here, is often very low in nutritive values. It would be very interesting to know the dairy conditions where such milk is produced. Here in Boston we examine milk continually, making bacteriological and chemical examinations, in order to keep it up to the standard. Our contractors are using every effort to keep the dairies in sanitary condition as a result of these examinations, and still with all that is going on it is with the utmost difficulty that we are able to keep some of these dairies even in a passable condition. What must be the condition of dairies where the only examination that is required is one for a percentage of fat when the milk is delivered at the creamery? I suppose that some of these people do try to produce clean milk, but I think we might fairly take as a sample the case of the Borden Condensed Milk Co., who, as it seems to me, have earned the condemnation of all right thinking people by the stand they have taken against pure milk in the fight they are waging against the Montclair, N. J., Board of Health. I have recently heard of an inspection that was made of the dairies of one other firm who make condensed milk. It was said that the dairies were in a most unsanitary condition, and it is legitimate to suppose that such dairies would be in fairly unsanitary condition where no inspection is required. Even if the milk is sterilized in the process of evaporation it would seem that with such dairy conditions as prevail it would be absolutely unfit for infant food, on account of its filthy condition before the process of evaporation.

There is one more point I thought of bringing out here, and that is the uncertainty as to the age of this milk as we buy it in the stores. There is nothing on the label to indicate when

the milk was produced. We buy a can of this milk in the store; it may be one year old or ten years old. If such milk is to be put on the markets there certainly should be some legal restriction. It should be required that it be dated, and after a certain time limit it should be destroyed. Such food must deteriorate in tin cans as much, it seems to me, as other foods we have heard so much about lately, deteriorate in cold storage. I have brought with me here one of the labels which reads:

"Prepared especially for infants. The most perfect substitute for mother's milk. Feed it to your babies and you will use no other." That last sentence, "Feed it to your babies and you will use no other," seems almost like a bit of prophecy. It reminds me of a sign I saw once in a restaurant window which read: "Eat here once, and you will never eat anywhere else."

Mrs. RICHARDS. I have been wondering where the Pure Food Law was that allowed these labels to continue. This case of dilution with 16 parts of water reminds me very much of the label on the old time package of Grape Nuts, which said: "This package contains as much nutriment as ten pounds of beef." I made a remark before a woman's club about that at one time, and immediately heard from the Grape Nuts people. I asked their representative to define what he meant by "nutriment"—if they meant to say that this little package of Grape Nuts had as much fat in it, or if it had as much proteid, or what it was that he called "nutriment." The only thing you could imagine would be that it contained more starch than ten pounds of beef. It does seem to me as though any label like that in regard to diluting condensed milk with water should be capable of criminal prosecution, because it is causing starvation.

As many of you know, we began our study for the children of Boston with the Orange County "evaporated" milk in 1890, because then the milk problem was in bad shape. We could get this milk then which we could sell to the poor mothers at six cents a quart, of as good value as we could get in the stores for that price and much cleaner and safer. We analyzed it, and kept track of it. It came from a carefully inspected establishment. It was evaporated at reduced pressure at 130° F. but not put up in cans. We used that for eight or ten years, and

we saved every baby we put on it. We had in ten years about 100 cases of children that had practically been given up. We had one very interesting case from a physician who sent word to us at the New England Kitchen that he wanted to try this milk on an out of town case. Some was sent, and I discovered later they had not sent any directions for diluting it. That milk was condensed four and a half to one and used undiluted. I expected the baby would die. On the contrary, we found that the baby had thrived from the first teaspoonful and would not take it diluted afterwards.

Dr. N. C. DAVIS. I would like to ask Professor Jordan in this connection a question which with these figures here it might be interesting to have answered. He has calculated in his first chart what the cost of this milk would be as compared with Massachusetts standard milk, 3.35 per cent. fat. It might be interesting to find out whether the cost would be increased over these figures on average Boston milk. That is, is the average standard of milk in the city of Boston above 3.35? If it is, wouldn't that make those figures still higher?

Professor JORDAN. Most certainly it would; but I have taken our standard as a basis for the calculation.

Dr. N. C. DAVIS. About how much higher would that make these figures using the fat content of average Boston milk as a basis for the calculation.

Professor JORDAN. I have no calculations to determine that, but the difference could readily be ascertained.

Mr. HARWOOD. (Barre). I consider this question one of the most important that has been brought before the public for a long time. I, myself, am interested in two phases of this question. One is public health, and the other is the welfare of our dairy interests. As a matter of fact, last year there were something like 6,000,000 less quarts of milk shipped into Boston than was the case in 1906. I have recently had occasion to do a little figuring on this subject. In 1906, in round numbers, there were 114,000,000 quarts of milk shipped into Boston by rail; last year there were 108,000,000. On the basis of the

increase of population—I took as the basis the increase from 1900 to 1905—if that same ratio had continued and the per capita consumption of milk had remained the same as estimated by the Department of Agriculture at Washington, there should have been 10,000,000 more quarts shipped into Boston last year than were shipped in here last year, or 4,000,000 more than were shipped here in 1906. What has taken the place of those 10,000,000 quarts of fluid milk which might have been shipped in here? It is reduced milk in some form or other, either condensed, or evaporated, or concentrated, or powdered milk, or all these together. It is not to be supposed that people have given up the use of milk. The use of this reduced milk has come to amount to something of no mean proportions; but the ignorance on the part of the people which up to now has existed in regard to the quality of condensed milk, it seems to me, is about to be dispelled when we get such a paper as we have heard today from Professor Jordan.

Covering this matter I drew a bill, after consultation with Professor Jordan and some others, and presented that bill to the Legislature, and what was the result? These great manufacturing concerns, one of which I understand is capitalized at \$35,000,000, and has, if I remember rightly, 65 different condensories scattered throughout this country from New York to California, together with some other large concerns, came down here to the Legislature, certain activities were started and this bill was simply snowed under. Some of the newspapers came out in the city of Boston and ridiculed the idea of such a bill. Before another year elapses I predict they will have a different view of this matter.

I hope that other organizations will take up this subject and that Professor Jordan and others who are competent to give proper information will be called upon to do so, in order that the public may become awakened and through them the legislators on Beacon Hill. That is the only way we can counteract the influence of great corporations. When the people become educated, then the consumers in this state will be protected, as they should be, by having proper labels upon containers of these reduced milks.

Someone has asked, "Where is the pure food law?" That pure food law, the United States government law which is popularly supposed to protect the people, is used to deceive, in a way, by these very manufacturers, because there is placed nothing further upon the package than that it contains pure milk, and says it is "guaranteed under the pure food and drugs act."

The number of cows in Massachusetts is 32,000 less than it was in 1890, and it has been growing less during the last three years at the rate of 4,500 a year. I contend that it is for the interest of every consumer in this Commonwealth that Massachusetts milk be produced for Massachusetts people and be produced so clean and in such good condition that it will have a name and a reputation for itself. Confidence between the consumer and the producer is the most important thing at this time, outside of this unfair competition. The welfare of the dairymen of this Commonwealth is more important than seems at first thought. Raising the price of fluid milk one cent a quart usually creates a great hue and cry, with the papers at least, and among many consumers, but what does it mean? Take milk at nine cents. People instead of paying that price run over to the grocery store and buy some of this reduced milk which you have heard discussed here today and pay a greater price for it. That, I contend, is foolish for the consumer and unfair to the producer.

We are entering an era of intensive agriculture. The consumers are complaining about high prices. These prices could be lowered if the production of food products was increased. How are we going to increase the fertility of our soil? Fires and improper cropping have removed the humus. You can buy commercial fertilizers and return elements of fertility to the soil, but the humus so necessary in the conservation of moisture and as essential as anything else to the rejuvenation of this soil cannot be put back except as it can be done economically. Green crops, as a rule, cost too much to plow in, and barn-yard manure remains the only profitable means of supplying that humus, in connection, of course, with the fertilizing elements which it contains. Destroy the animal husbandry of this state,

as is being done at the present time through low prices and unfair competition, and you still further destroy the producing power of the soil.

What does this raise of a cent on a quart of milk amount to? It amounts to comparatively nothing in the end, not more than about \$1.20 a year per person. That does not seem much, while if measures are taken to build up the animal industry in this state, improve the fertility of the soil, increase the crops and secure a better milk product, the consumer would be one of those most benefited. I contend therefore, that it is in the interest of everybody in this Commonwealth to join with the agricultural interests and by improving the dairy industry bring back the fertility of the soil, and I consider this discussion here today one good move in that direction.

Dr. CHAPIN (Providence). There is one point that has not been emphasized, or at least not very strongly, namely, the danger from condensed milk due to keeping the can open in the house. That subject has been investigated quite a little in England. Sandilands, in London, studying the incidence of summer diarrhoea, found, as others have, that it falls with exceptional severity upon children fed on condensed milk. In that section of London where he worked, the milk that was used was chiefly Nestle's. He investigated the conditions under which it was put up in Switzerland and found that they were almost ideal, that the dairies were in fine condition and the chance of infection of the milk was very small. But when the cans are opened and kept open in the house they can be seen black with flies; they remain that way for two or three days to a week. He believes, as do very many of the leading English health officials, that the chief cause of infantile diarrhoea is infection in the house, and they believe that there is no easier way to get that infection into the child than by the use of condensed milk.

To Professor Jordan we owe a debt of gratitude for this paper. He has worked hard to get the facts, and has presented the facts in a clear manner, and they are facts that everyone of us wants to use every day in our fight against these evil influences. I would like to ask Professor Jordan if he knows anything about

the dried milk which they are using a good deal in England. Some of the health officials there speak very highly of it, and at the municipal milk depot in Sheffield they have been using it in place of the clean milk or the sterilized milk such as we use here. There are also favorable references to it in other English health reports.

Professor JORDAN. In answer to Dr. Chapin, I wish to say that some time ago I investigated a powder made from skimmed milk, which was recommended for bakers use because of its low cost. I found that when used according to directions, a very low grade of skimmed milk resulted, but that if enough of the powder was employed to make a skimmed milk which agreed with the Massachusetts standard, the cost more than equaled that of skimmed milk. Last summer we had occasion to examine one of the powdered milks sold in cans, and I made no calculations as to the cost of the fluid product. A solution could be made from it which approximated the composition of the standard milk of this State; the powder, however, was not free from bacteria.

Prof. M. J. ROSENAU. I am very much surprised to hear that some of these canned milks have such a low nutritive value, and are sold at such a comparatively high price. It was further a matter of surprise to me that sweetened condensed milk is far from being sterile, but contains a large number of bacteria, in certain cases as high as 10,000,000 per cubic centimeter. Such a milk would not be allowed to be sold in accordance with the city regulations were it sold just as milk.

It seemed to me that Professor Jordan in his conclusions has been quite conservative. He might have gone a good deal further, because all of those who have dealings with the children's diseases know that the larger per cent. of rickets and scurvy occur among those babies who have used this class of milk as the chief article of food. There is something about it which predisposes particularly to the nutritional diseases of this class.

The key-note of the whole matter is not a desire to abolish the use or sale of this particular class of milk, for it has a certain place in our dietary, and in our condensed civilization it has

certain uses on account of its keeping qualities; but the whole point is that it should be labeled honestly and sold for just what it is. The statements on the labels, as pointed out in Professor Jordan's paper, at times are so at variance with the facts as to the contents of the cans that these particular brands should come under the purview of the pure food and drug law, since they involve just as much fraud as selling other things mislabeled in many other ways.

These are the chief facts that occur to me, and I thank you very much, Mr. Chairman, for this opportunity to commend and endorse this able and timely paper.